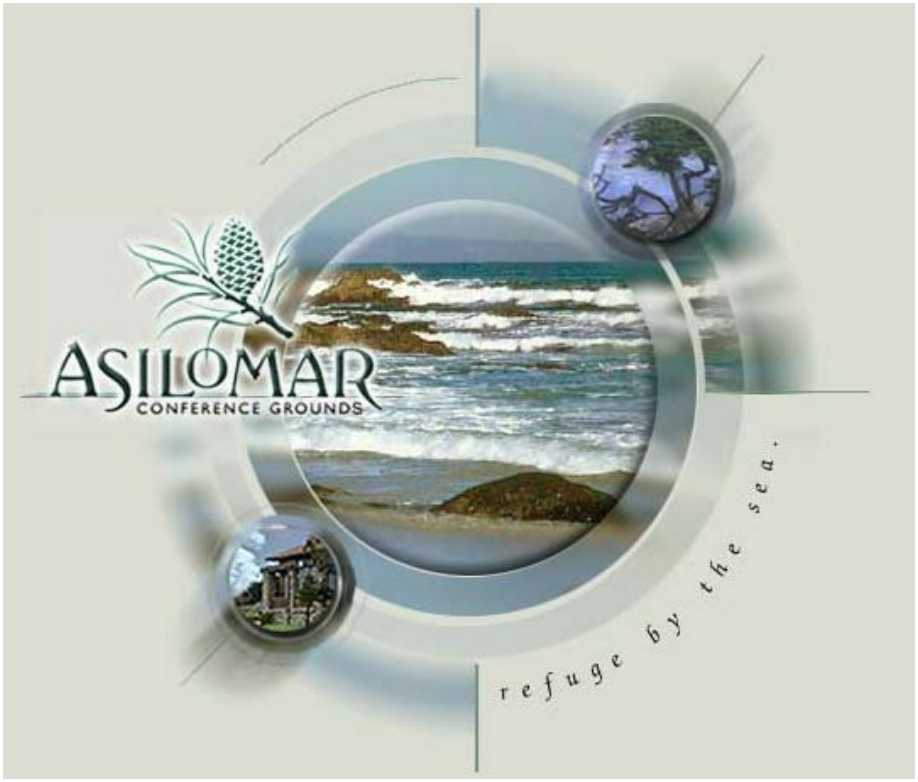
California Water and Environmental Modeling Forum

2007
Annual Meeting
Abstracts

"California Water: Where Change is Constant"



February 26-28, 2007

Asilomar Conference Grounds
800 Asilomar Boulevard
Pacific Grove, California

California Water and Environmental Modeling Forum
2007 Annual Meeting Summary of Sessions

Monday, February 26, 2007

Time	Session	Moderator	Location
10:15 am-12:00 pm	1: 2006 CalSim-II Developments and Applications	Sushil Arora	Fred Farr
	2: 2006 DSM2 Developments and Applications	Parviz Nader	Oak Shelter
12:00-1:00 pm	Lunch	---	Dining Hall
1:15-3:00 pm	3: CalSim-III Developments I	Hongbing Yin	Fred Farr
	4: Modeling Issues of the Delta	KT Shum	Oak Shelter
3:00-4:00 pm	Registration	---	Social Hall
4:15-6:00 pm	5: CalSim-III Developments II	Hongbing Yin	Fred Farr
	6: South Delta & Lower San Joaquin River Water Quality	Paul Hutton	Oak Shelter
6:00-7:00 pm	Dinner	---	Dining Hall
7:00-10:00 pm	7: Reception I and Poster Session	Mike Deas	Fred Farr
8:00-9:00 pm	Keynote Speaker: "Flood Risk Management and the Future of the Delta," Jeffery Mount (Professor, U.C. Davis Department of Geology)	KT Shum	

Tuesday, February 27, 2007

Time	Session	Moderator	Location
7:30-8:15 am	Breakfast	---	Dining Hall
8:15-9:00 am	8: CWEMF Activities / Annual Business Meeting	KT Shum	Fred Farr
9:00-10:00 am	Revision of CWEMF's Modeling Protocols Document	Rich Satkowski	
10:15 am-12:00 pm	9: Delta Risk Management Strategy	Ralph Svetich	Fred Farr
	10: 2006 IWFM Developments and Applications	Tariq Kadir	Oak Shelter
12:00-1:00 pm	Lunch	---	Dining Hall
1:15-3:00 pm	11: Sharpening Tools for the Next CA Water Plan Update	Rich Juricich	Fred Farr
	12: Modeling Conjunctive Use in the Central Valley	Julien Harou	Oak Shelter
3:00-4:00 pm	Registration	---	Social Hall
4:15-6:00 pm	13: Screening/Decision Support Modeling for CA Water	Armin Munevar	Fred Farr
	14: Integrated Regional Modeling	Ali Taghavi	Oak Shelter
6:00-7:00 pm	Dinner	---	Dining Hall
7:00-10:00 pm	15: Reception II	Rich Satkowski	Fred Farr
7:45-8:30 pm	Hugo B. Fischer Award/Presentation by Recipient	Nigel Quinn	
8:30-9:15 pm	Career Achievement Award/Presentation by Recipient		

Wednesday, February 28, 2007

Time	Session	Moderator	Location
7:30-8:15 am	Breakfast	---	Dining Hall
8:15-10:00 am	16: Early Awakenings for Delta Visions	Jay Lund	Fred Farr
	17: General Reservoir Simulation Model Applications	Leslie Stillwater	Oak Shelter
10:15 am-12:00 pm	18: Temperature Modeling and Applications	Mike Deas	Fred Farr
	19: Climate Change Modeling	John Andrew	Oak Shelter
12:00-1:00 pm	Lunch / Check-Out	---	Dining Hall
1:00-2:40 pm	20: Water Community Program Updates	Fred Feyrer	Chapel
2:00-4:40 pm	21: IEP / CWEMF Joint Modeling Session	Paul Cadrett	Chapel
4:40-6:00 pm	IEP Registration	---	Social Hall
6:00-7:00 pm	Dinner	---	Dining Hall
7:00-9:00 pm	22: IEP Social and Guest Speaker: "Monterey Bay Aquarium's White Shark Research Program," John O'Sullivan, Curator of Field Operations	IEP Rep	Chapel

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Version Date: February 23, 2007

Monday, February 26, 2007

10:15 a.m.-12:00 p.m.

Session One: 2006 CalSim-II Developments and Applications

Moderator: Sushil Arora (CA DWR); Location: Fred Farr Forum

Development of CalSim-II Model for Common Assumptions Process for the Surface Storage Investigations, Rob Leaf and Brian Van-Lienden (CH2M Hill)

Abstract: The Common Assumptions effort is a concerted effort by the Authority, Reclamation, and the Department to coordinate and implement an analytical framework to support the common needs of the CALFED Surface Storage investigations. As part of this framework a Common Model Package has been developed that includes component models to evaluate the water resource system (CALSIM II), Economics (LCPSIM, CVPM), Delta flow and salinity (DSM2), Sacramento River temperature (SRWQM), salmon production (SalMod), and power generation and use (LTGen and SWP_Power). Each of these models have undergone significant enhancements as part of the development of the Common Model Package and protocols have been developed to integrate the models together so that they can be used as part of a comprehensive evaluation. The draft Common Model Package is currently being jointly reviewed by the Department and Reclamation with the goal of developing and accepting a final package that will be used for analysis of feasibility studies by the surface storage investigation teams.

Updated Delta-Flow Salinity ANN module in CalSim-II/CalSim-III Model; and Its Application as a Forecasting Tool, Shengjun Wu and Sanjaya Seneviratne (CA DWR)

Artificial neural networks (ANN) are used to determine the flow salinity relationships at key locations in the Delta to facilitate fast execution of CalSim model. An improved ANN, and better implementation of ANN in CalSim has yielded in a more accurate estimate of salinity at locations where salinity standards have to be met. At present, salinity at these locations can be determined by running the Delta Simulation model (DSM2) or ANN inside CalSim. To run both models require a certain amount of expertise and is time consuming. “Salinity forecasting tool” is a spreadsheet-based program employing pre-training ANN for forecasting salinity at key locations in the Delta. It was developed using Microsoft Visual Studio 2005. This program has the ability to forecast salinity very quickly and requires very little modeling experience.

Delta Water Demands using DETAW and the New Delta Representation in CalSim-II/CalSim-III Model, Tariq Kadir (CA DWR)

The Delta Evapotranspiration of Applied Water model DETAW is a GUI driven tool written in C^{++} for estimating daily land use based water demands in the Sacramento – San Joaquin Delta. Results from DETAW for the period 1922-2003 using both estimated historical land use development and current level land use development will be presented and compared to other estimates of Delta water demands including CalSim-II’s CU model, DSM2, and DAYFLOW. A new representation of the physical Delta for use in CalSim-III will also be presented.

Status Report on WRIMS Software Development and Testing for use in CalSim-II/CalSim-III Model, Clay Booher and Ryan Wilbur (CA DWR)

The Water Resource Integrated Modeling System (WRIMS) 2.0 software is the second generation CalSim modeling system. This update to the development of WRIMS 2.0 includes further improvements in the model solution procedure (bug fixes and code improvements). A Java interface to external functions (including the ANN Window dynamic link library) is almost complete. Extensive testing of the WRIMS 2.0 software with the Common Assumptions model is ongoing and issues between the software and model are being found and corrected. Development of results visualization tools based on HEC products are in the intermediate stage. Development of an interactive schematic for data input and output data viewing is in the intermediate stage.

Session Two: 2006 DSM2 Development and Applications

Moderator: Parviz Nader-Tehrani (CA DWR); Location: Oak Shelter

A Method to Improve DSM2/QUAL Accuracy: Using Salinity Fingerprints to Detect and Remove Model Bias, Marianne Guerin and Tom Rose (CCWD)

DSM2 has the capability of providing 'fingerprints' in its transport calculations – this output yields source-specific information on the volume and/or salinity of water found at user-defined locations in the model grid. We used the DSM2 Historical model and salinity fingerprinting to characterize the source (e.g., Martinez) of modeled EC error. The assumption was that systematic bias associated with boundary salinities could be detected using the fingerprints and used to improve the accuracy of EC calculations. In this talk, we demonstrate this methodology and give an example of the improvement in the accuracy of calculated EC. Although the original objective was to improve Real-Time DSM2 forecasting predictions, the method should prove useful in other contexts

Forecasting Contaminant Movement in the Delta Using the DSM2 Historical Model Marianne Guerin (CCWD)

When a potentially hazardous agent is introduced into a water body that supplies drinking water, there are competing demands for speed and accuracy in predicting the contaminant movement to protect public health and prevent consumption of the contaminant. I'll explain a method of getting 'quick-and-dirty' predictions of contaminant movement in the Delta using PTM and the Historical model output. I'll demonstrate the ideas using a hypothetical and an actual spill in the Delta and give estimates of the accuracy that might be expected using these techniques.

Adaptive Management of Flow through Three Mile Slough to Improve Delta Water Quality (DSM2 Modeling Experiments), Bijaya Shrestha and Parviz Nader-Tehrani (CA DWR) (.PDF; 5 MB)

One of the major reasons Delta water quality degrades is due to ocean salt intrusion. This is particularly pronounced during the periods with low net Delta outflow, combined with high pumping. DSM2 modeling experiments have illustrated that a gate, strategically located in Three-Mile Slough, has the potential to reduce ocean salt intrusion in the Delta, thus improving water quality. It has further been demonstrated that such a gate has the potential to reduce the salinity intrusion caused by small to medium scale levee failures. Preliminary results indicate that the operation of this hypothetical gate may have only a small impact on fisheries. In fact, during the times that there is no concern for ocean salinity intrusion, the Three-Mile Slough gate may be operated to benefit the migrating fish in the Sacramento River.

DSM2 Version 7 Implementation Status, Eli Ateljevich (CA DWR)

DSM2 Version 7 is the newest release of DSM2. It features operating rules, flexible gate structures, a more robust solver and a database management system. The talk will include description of new work using the new version of DSM2 and describe implementation within the Delta Modeling Section.

1:15-3:00 p.m.

Session Three: CalSim-III Developments I

Moderator: Hongbing Yin (CA DWR); Location: Fred Farr Forum

Overview of CalSim-III Hydrology Development, Hongbing Yin (CA DWR)

There has been a well-recognized need to refine and enhance the current representation of Sacramento Valley in CalSim-II. Accurate simulation of Delta inflow requires accurate modeling of project demands on project reservoirs, non-project use of surface water, and groundwater pumping. The current coarse representation of demands in the Sacramento Valley lacks of the associations of demands with the correct water supply sources and relies on a simplified method of disaggregating project from non-project demands. Water use efficiency parameters used to calculate diversion requirement also need be updated. The goal of CalSim-III Hydrology Development is to improve the accuracy of SWP and CVP water supply estimates by developing a new set of hydrology in Sacramento Valley that minimizes these deficiencies with the data available.

CalSim-III Surface Water Representation (Water Budget Areas, Demand Units, and Model Schematic), Todd Hillaire (CA DWR), Jeff Payne (MWH) (.PDF; 2 MB)

A first step for the CalSim-III Hydrology Development Project was revisiting CalSim's surface water representation. Changes in both spatial scale and nomenclature were implemented with four general goals in mind: (A) to better accommodate input data provided by DPLA, (B) to allow node-to-node comparison with C2VSIM, (C) to appropriately represent water-users' physical access to surface water and return flows, and (D) to improve the communication of CalSim's structure and results with the general public.

As a result, the Sacramento Valley's schematic has been substantially revised. The calculation of water use in the Sacramento Valley, once performed for seven Depletion Study Areas, is now performed for 115 'demand units', being clusters of water users with a like-priority, physical access, and application of water (e.g., CVP Settlement Contractors, SWP irrigators, project refuges, non-project M&I). Generalized Water Budget Areas have been drawn to provide a physical location (i.e. an address) for the large number of new computational units. The new schematic illustrates the inter-connectivity and inter-dependence for the various water users and uses in the Sacramento Valley.

CalSim-III Agricultural Demand using IWFM Calculator (IDC), Can Dogrul (CA DWR)

IWFM Demand Calculator (IDC) is a stand-alone, physically-based soil moisture accounting tool that is extracted from DWR's Integrated Water Flow Model (IWFM). It simulates land-use based surface runoff of precipitation, agricultural demand, groundwater recharge and return flow from irrigation water. This presentation will detail the simulation methods used in IDC and its implementation in Calsim-III hydrology development.

Agricultural and Urban Water Demand and local Water Supply Representations in CalSim-III, Messele Ejeta (CA DWR), Lee Bergfeld (MBK) (.PDF; 1 MB)

One of the important improvements made in CalSim-III is the disaggregation of the large Depletion Study Areas (DSA) to finer resolution Water Budget Areas (WBA). Agricultural, urban, and refuge demands are calculated at the finer resolution throughout the Sacramento Valley. The level of detail in CalSim-III allows for verification of existing level demands and improved representation of local water supplies including surface water, groundwater, and agricultural return flows.

Session Four: Modeling Issues of the Delta (.PDF; 1.2 MB)

Moderator: KT Shum (EBMUD); Location: Oak Shelter

This public forum will focus on two outstanding issues identified in the February 6 CWEMF Workshop on Delta modeling issues: quantifying model performance and simulating seawater intrusion. Each issue will begin with an overview followed by open discussion. The discussion on the performance metrics to be used specifically for DSM2 simulations will be led by Tara Smith, Chief of the Delta Modeling Section at DWR. The discussion on simulating seawater intrusion will begin with a review by Edward Gross on potential applications of three-dimensional models to guide empirical formulations in one-dimensional Delta models. Edward Gross is an environmental consultant and performs numerical simulations in several research and consulting projects that address flow and transport processes in San Francisco Bay and the western Delta.

Performance Metrics in DSM2 Historical Simulations, Tara Smith (CA DWR)

The Delta Modeling Section at DWR is developing a list of metrics to be used to quantify DSM2's performance. The focus will primarily be on historical simulations but performance measures for current and potential DSM2 planning and forecasting applications will also be considered. A number of considerations were brought up in the February 6 CWEMF Workshop on Delta modeling issues. Proposed metrics include (see presentations IIB.22 through IIB.28 on http://www.cwemf.org/workshops/6feb07wrkshp.htm)

- Differences in amplitude and phase between field data and model output for instantaneous values of stage and flow
- Statistical measures of the differences between field data and model output for tidal averages of stage and flow
- Weighting schemes for the differences between field data and model output at locations of significance as Delta standards and/or water management objectives
- Differences in amplitude and phase in astronomical tide components (from harmonic analyses) between field data and model output for stage and flow
- For the transport model, the following issues were brought up:
- Decomposition of the different sources of salt ("finger-printing") to aid in analysis of transport processes
- Use of sensitivity analyses to address uncertainties in model input
- Separating the advective (in this case refers to the tidally-averaged value) and dispersive (the tidally-varying component) salt transport in comparison with field measurements
- The session will briefly summarize these issues and then open up for reactions and comments from the audience.

Simulating Seawater Intrusion, Edward Gross (Environmental Consultant) (.PDF; 1.8 MB)

The mechanisms of salt transport and seawater intrusion are complex in Suisun Bay, Carquinez Strait and the western Delta. Delta models approximate the net effect of several mixing processes via empirical formulations, through a diffusion-type model, and adjust the empirical parameters through a calibration process. This approach has achieved some success in matching model output and field data for historical conditions. However, the accuracy of modeling results is of concern in studies of different Delta or Suisun Bay geometry or different hydrodynamic conditions for which the empirical parameters set in the calibration effort may not be appropriate. More extreme examples of such studies include massive levee failures, sea level rise, and alternative Delta configurations (the "Delta vision" alternatives).
The session will begin with a brief overview of the issues with current formulation, in particular:

- the use of surface shore salinity to represent "cross-sectional" average when vertical and lateral stratification could be significant and highly variable
- the discrepancy between measured and simulated boundary salinity during ebb tides and hence the potential difference in net salt flux across the boundary
- the use of a constant dispersion coefficient to approximate tidal dispersion that could change with hydrological conditions and the phase in astronomical tide

The main presentation will focus on the possibility of using three-dimensional model results to improve the accuracy of salt transport in one-dimensional and depth-averaged models. In contrast to one-dimensional and depth-averaged models, three-dimensional models could explicitly resolve all important transport processes provided that the model grid is fine enough to resolve these processes (and reliable approximation of subgrid scale processes could be achieved). In these cases, the strength of individual transport processes can be estimated by analysis of model results. These results can also be applied to estimate dispersion coefficients for different conditions, including a large range of Delta outflow, sea level rise and altered Delta geometry. An example of this approach is the DRMS project in which dispersion coefficients were estimated for use by a tidally-averaged one-dimensional model.

4:15-6:00 p.m.

Session Five: CalSim-III Developments II

Moderator: Hongbing Yin (CA DWR); Location: Fred Farr Forum

Linking CalSim-III to C2VSim via the Use of Discrete Kernel - (1) Theory, Chuck Young (SEI)

The Stockholm Environment Institute has modified the representation of groundwater in CalSim-III through the use of discrete kernels. Discrete kernels are the ratio of a response such as a change in groundwater or stream head to a stress such as pumping or a change in stream flow. This presentation will discuss the generation of discrete kernels using the C2VSIM model and their application using the concept of artificial steady state. A following presentation will cover the implementation of the discrete kernel approach in the CalSim-III context.

Linking CalSim-III to C2VSim via the Use of Discrete Kernel - (2) Implementation Brian Joyce (SEI)

The Stockholm Environment Institute has modified the representation of Sacramento Valley groundwater in the CalSim-III planning model. The approach implemented in this work used discrete kernels to link CalSim-III to a physically based model of the Central Valley groundwater system (C2VSim), in a manner similar to the linkage of CalSim-III to the physically based hydraulic model of the Delta (DSM2) through the use of the ANN. This direct linkage between

models also permits for a representation in CalSim-III of groundwater impacts that are commensurate with the spatial discretization of the distributed groundwater flow model. CalSim-III can then begin to represent site-specific impacts on the groundwater system in a manner that will enable the model to consider the cumulative impacts of local water management projects employing recharge basins and extraction wells, such as Phase 8 and the Sacramento Valley groundwater management programs, on groundwater elevations or stream flows at specific locations along the river.

CalSim-III Implementation and Initial Results, Andy Draper (MWH Americas) (.PDF; 1 MB)

CalSim-III provides a comprehensive revision of CalSim's representation of the Sacramento Valley. Changes to the model include revisions to surface water supplies and agricultural and urban water use. An enhanced spatial resolution provides model results at a meaningful scale to water agencies and districts. Simulation of groundwater heads at an approximate 4-mile grid allows much improved modeling of groundwater conditions, and surface water-groundwater interaction. An initial assessment of the effects of the CalSim-III model enhancements are discussed with reference to surface water and groundwater use.

4:15-6:00 p.m.

Session Six: South Delta and Lower San Joaquin River Water Quality

Moderator: Paul Hutton (MWDSC); Location: Oak Shelter

Overview of the South Delta Improvement Program (SDIP) and San Joaquin River Efforts
Paul Marshall (CA DWR)

The South Delta Improvements program is a staged effort to improve circulation in south Delta channels and improve flexibility in the protection of San Joaquin River salmon through the installation of four permanent operable gates and dredging. The SDIP is only one of several efforts to improve water quality in the south Delta and lower San Joaquin River.

SDIP Gate Operations and South Delta Water Quality, Kyle Winslow (CH2M Hill)

A series of DSM2 simulations have been conducted to investigate the influence of SDIP barrier operation on flow, stage, and water quality in the South Delta. Modifications have been made from the "Modified Plan C" operational plan in order to reduce selected stagnation events in South Delta channels. Comparisons have been made to DSM2 simulations reflecting temporary barriers in the South Delta. DSM2 QUAL was used in fingerprinting mode to quantify variations in source water at export locations for changes in barrier operation. DWR's Particle Tracking Model (PTM) was used to demonstrate visually the variations in circulation patterns in South Delta channels for the temporary and permanent barrier simulations.

SWRCB Modeling I – Historical Modeling, Tara Smith (CA DWR)

In May, 2005 the State Water Resources Control Board issued a draft Cease and Desist Order to the United States Bureau of Reclamation and the California Department of Water Resources for the threatened violation of their permit and license conditions requiring compliance with the salinity objectives in the interior southern Sacramento-San Joaquin Delta. In January 2007 the SWRCB held a separate workshop to obtain information concerning the salinity objectives in the southern Delta in response to a court opinion regarding how the objectives were set. This presentation will cover the historical modeling completed by DWR staff and presented in the October – November 2005 Hearings and in the January 2007 workshop. For the modeling, historical Delta Simulation Model 2 (DSM2) simulations and modified historical simulations with

reductions in State Water Project exports, and modified historical simulations with increases in Sacramento flow were made to illustrate the amount of control that DWR operations have on water quality at the objective locations. The modeling analysis used DSM2 fingerprinting to determine the sources of water at the southern Delta salinity objective locations.

SWRCB Modeling II – Data Analysis and Particle Tracking Modeling
Parviz Nader-Tehrani (CA DWR)

This presentation will cover the data analysis and particle tracking modeling completed by DWR staff and presented in the October – November 2005 Hearings and in the January 2007 workshop. For the data analysis, a relationship of the water quality degradation between Vernalis and Brandt Bridge using available observed data was developed. The particle tracking modeling was used to visually show flow patterns in the Delta under different hydrological conditions using different temporary barrier and permanent gate configurations.

7:00-10:00 p.m.

Session Nine: Evening Program
Moderator: KT Shum (CWEMF Convener/EBMUD); Location: Fred Farr Forum

7:00-10:00 p.m. Reception I and Poster Session

Please see poster abstracts at the end of this document.

8:00-9:00 p.m. Keynote Speaker: Jeffery Mount (Professor, U.C. Davis Department of Geology)

Flood Risk Management and the Future of the Delta

The Keynote Speaker will discuss flood risk management and the future of the Delta including the 2007 PPIC report, which explores and compares long-term Delta solutions.

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Tuesday, February 27, 2007

8:15-10:00 a.m.

Session Eight: CWEMF Activities / Annual Business Meeting / Modeling Protocols Revision

Moderator: KT Shum (CWEMF Convener / EBMUD); Location: Fred Farr Forum

The CWEMF will (1) report on 2006 model user groups, technical workshops, peer reviews and administration activities and (2) hold its Annual Business Meeting. As part of its mission, the CWEMF orchestrates and manages impartial peer reviews of models. In October 2006, the CWEMF prepared a "CWEMF Peer Reviews" document, which outlines the steps a CWEMF Peer Review.

The CWEMF is in the process of revising its 2000 document "Protocols for Water and Environmental Modeling" (www.cwemf.org/Pubs/Protocols2000-01.pdf). The purpose of the document is to provide modeling principles and guidelines (protocols) to guide stakeholders and management and technical staff in developing models and in applying modeling tools to solve California's water and environmental problems. The 2000 Protocols document, along with the complementary documents "Strategic Analysis Framework for Managing Water in California (www.cwemf.org/Pubs/StrategicFrameworkRpt.pdf) and "CWEMF's Peer Reviews" (www.cwemf.org/Pubs/CWEMFPeerReviews.pdf), provide the CWEMF's vision of best modeling practices (BMPs) to (1) improve understanding and acceptance of models and modeling results and (2) increase their role in informed water management decisions. The purpose of this update is to incorporate the latest developments in the California water community and provide more details on issues that are gaining prominence, such as shared vision modeling and model integration. The CWEMF is soliciting input into in identifying specific sections where an update or more detailed discussion would help California water stakeholders and decision makers.

Finally, the CWEMF will solicit suggestions for technical workshops and projects in 2007.

10:15 a.m.-12:00 p.m.

Session Nine: Delta Risk Management Strategy

Moderator: Ralph Svetich (CA DWR); Location: Fred Farr Forum

Delta Risk Management Strategy Overview, Ralph Svetich (CA DWR)

The Delta Risk Management Strategy (DRMS) came about as a result of work from the CALFED ROD, and later legislation (AB 1200) put into law the need for a risk evaluation of the Sacramento-San Joaquin Delta levees. DRMS goals and objectives are: for Phase 1 – Evaluate the risk and consequences to the State (e.g., water export disruption and economic impact) and the Delta (e.g., levees, infrastructure, and ecosystem) associated with the failure of Delta levees and other assets considering their exposure to all hazards (seismic, flood, subsidence, seepage,

sea level rise, etc.) under present as well as-foreseeable future conditions (50, 100, and 200 years). For Phase 2 – propose risk criterion for consideration of risk management strategies for use in management of the Delta and Suisun Marsh. Develop a DRMS strategy including a prioritized list of actions to reduce and manage the risks or consequences associated with Delta levee failures, as identified in Phase 1. The Phase 1 report is currently being finalized and will be available for public viewing in mid-April 2007.

Potential Impact Hazards Analysis, Said Salah-Mars (URS Corp.)

The California Department of Water Resources is conducting a Delta Risk Management Strategy (DRMS) to evaluate the risk of levee failure in the Sacramento-San Joaquin Delta and Suisun Marsh (The Delta) under present and foreseeable future events and conditions (50, 100 and 200 years from now). Further the study is also to address the risk management strategy to reduce and manage those risks. There are approximately 1,100 miles of levees protecting over 62 low-lying islands in the Sacramento-San Joaquin Delta and approximately 230 miles of levees protecting over 50,000 acres of marsh land in the Suisun Marsh.

This paper provides an overview of the DRMS work and outlines the relationships between 15 disciplines including: 1) Seismic hazard, 2) Flood hazard, 3) Climate change, 4) Subsidence, 5) Geomorphology, 6) Wind-wave hazard, 7) Levee vulnerability, 8) Hydrodynamic modeling, 9) Emergency response, 10) Water quality, 11) Water management and operation, 12) Impact to ecosystem, 13) Impact to infrastructure, 14) Regional and State economic impacts, and 15) Risk Assessment.

Risk Analysis Approach and Water Modeling, Bill Betchart (Jack R. Benjamin & Associates)

Within DRMS, a structured method for analyzing and quantifying risk is central. This method is applied first to develop a 2005 base case and then to characterize risk in future year base cases. It begins with definition of the state of California, the Delta, and the environment. It then defines the hazards (normal, seismic, and flood) that threaten Delta levees – in terms of all possible events that could lead to levee failures and their likelihood of occurrence. The vulnerability of levees to these events is defined quantitatively (levee fragility) and failures are calculated for each event. In cases that have levee failures, an Emergency Response and Repair model is used to detail repair efforts and schedules. A Water Analysis Module is used to specify water management decisions (e.g., reservoir releases and export pumping) and to calculate salinity impacts in the Delta. Consequences are then tabulated for ecosystem impacts, local Delta economics, infrastructure disruption, water export disruption and impacts on the state's economy. This presentation will emphasize the role of the Water Analysis Module in the risk analysis and provide an overview of its components, structure, and operation.

Developing a Salt Transport Model for Rapid Analysis of Levee Breach Events in the Sacramento-San Joaquin Delta, John F. DeGeorge (RMA) (.PDF; 1.6 MB)

The Delta Risk Management Strategy (DRMS) Phase 1 Risk Analysis requires evaluation thousands of possible levee breach events in the Sacramento-San Joaquin Delta. A new tidally averaged salt transport model has been developed to function within the Water Analysis Module (WAM) of the DRMS Risk Analysis Framework that is capable of rapidly simulating Delta salinity during flooding, flushing, and repair periods following breach events. Reservoir operation logic and Delta simulation are coupled within the WAM on a daily basis. The new model utilizes the RMA2/RMA11 finite element engines and represents the system with a network of simplified one-dimensional channels from the central San Francisco Bay to Sacramento and Vernalis. Islands that may be flooded are also represented as 1-D channel networks, often with multiple breach locations. Net flow simulation is driven by the typical boundary inflows, exports, and Delta Consumptive with additional forcing of important internal flow splits to approximate tidally driven

net flows. Tidally averaged dispersion estimates are based analysis of tidal simulations using the RMA Bay-Delta Model and Trim/UnTrim 3D Models of the system. Calibration results are presented for 1991-2003 and Jones Tract event, and several breach events simulated with the RMA Bay Delta Model.

Three-Dimensional Simulations and Analysis of Salt Transport for the Delta Risk Management Strategy, Edward Gross (Consultant) and Michael MacWilliams (Consultant) (.PDF; 2.5 MB)

Three-dimensional simulations of circulation and salinity in the San Francisco Estuary were performed to support the Delta Risk Management Strategy (DRMS). The TRIM applications used a previously developed and calibrated model to estimated dispersion coefficients which are now used in a one-dimensional tidally-averaged model developed as part of the Water Analysis Module (WAM). An UnTRIM model was developed that extends further into the Delta than the TRIM model. The UnTRIM model uses a flexible unstructured model grid consisting of quadrilaterals and triangles and allows for higher resolution through Suisun Bay and the Western Delta to more accurately represent the geometry of the estuary. The goals of the UnTRIM applications were: 1) to estimate the importance of stratification and velocity shear on salt transport for a small number of DRMS scenarios; 2) inform uncertainty analysis of the WAM predictions; and 3) simulate seawater intrusion for several idealized sea level rise scenarios. The presentation will briefly describe the three-dimensional applications and present a portion of the model results.

Session Ten: 2006 IWFM Developments and Applications

Moderator: Tariq Kadir (CA DWR); Location: Oak Shelter

IWFM Version 3.0, Can Dogrul (CA DWR)

IWFM Version 3.0 is scheduled for release to the public by DWR in February 2007. This new version includes a modified root zone moisture routing module, and the capability to read from and write to HEC-DSS files. The presentation will detail these major enhancements and other modifications in this version of IWFM.

C2VSIM Calibration: Water Budgets, Stream Flows, and Groundwater Elevations, Charlie Brush (CA DWR) and Steve Shultz (CH2M Hill) (.PDF; 10 MB)

An integrated groundwater-surface water model for California's Central Valley was developed for the period from October 1921 through September 2003 using the finite element application IWFM. Optimum hydraulic parameters were selected using the parameter estimation program PEST to obtain the best match to historical groundwater heads and stream flows. The initial calibration was performed to match data from October 1975 to September 2003, and subsequent calibration extended the data set to October 1921 through September 2003.

Butte County IWFM Model, Brian Heywood (CDM) (.PDF; 5 MB)

With the increasing need to understand groundwater resources in the Butte County area, a previous groundwater flow model has been rebuilt and calibrated using the Integrated Water Flow Model (IWFM) code. Covering over 1 million acres, the new Butte County IWFM model will have applications on the local and regional scale. Potential uses of the model include supporting the County's Integrated Water Resources Plan, understanding groundwater recharge area opportunities and constraints including the Tuscan aquifer system, and understanding the effects of potential conjunctive water management projects in the County.

Application of IWFM to the Evaluation of Conjunctive Use in Solano and Yolo Counties, Kenneth Loy (West Yost Associates) (.PDF; 4.5 MB)

An IWFM application was developed to evaluate conjunctive use in a portion of the Solano Sub-basin. Reclamation District 2068 provides surface water to farmers within a 13,000-acre service area located in Delta uplands of the northern Sacramento-San Joaquin Delta. The District has not used groundwater and has no groundwater facilities. The District's typical diversions from the Delta have ranged from approximately 45,000 to 52,000 acre-feet per year. If a portion of the agricultural demand served by these diversions could be met using groundwater, surface water could, at times, be made available in the Delta for use by others as a dry-year supplemental supply. The IWFM application provided an initial assessment of the volumes of groundwater that could be pumped and the potential changes in groundwater levels, assuming historical hydrologic conditions and current land and water use are representative of future conditions.

1:15-3:00 p.m.

Session Eleven: Sharpening Tools for the Next California Water Plan Update

Moderator: Rich Juricich (CA DWR); Location: Fred Farr Forum

Delivering Numbers with SWAN – Statewide Water Analysis Network, Rich Juricich (CA DWR)

An overview will be provided of activities by DWR to improve the analytical framework for future Updates of the California Water Plan including the proposed public process and schedule for the next Update. The use of scenarios to describe several different plausible futures has emerged as a vital piece of this future work. In addition, a critical issue facing California is the need for better tools and data to produce useful information about and explore relationships between *supply reliability, environmental objectives, water quality, economic performance, social equity objectives, and hydrologic uncertainties*. Staff is working through the Statewide Water Analysis Network, SWAN, to develop both a short-term analytical approach for the next Water Plan Update and a long-term vision. The remaining presentations in this session will highlight some of the ongoing staff work to improve analytical tools and data.

Conceptualizing California's Water Management System with UML

Morteza Orang and Dong Chen (CA DWR)

An experimental effort by DWR to apply object-oriented modeling techniques, using the Unified Modeling Language (UML), will be presented to portray how DWR currently measures and reports recent urban water use. This effort is meant to test the potential for applying object-oriented modeling techniques, and the UML notation, to discuss and develop the approach and tools needed to produce some of the quantitative deliverables desired for the next California Water Plan Update. DWR is promoting the use of an iterative development process used widely in the software development industry to assist with the development of a conceptual model of the water management system. This iterative approach allows a team to identify and describe the relevant aspects of the real world that should be represented in an analytical tool. The conceptual model can be developed collaboratively to document the requirements of the system and a shared understanding of the water management system. DWR is documenting the products developed through the iterative process by using UML, which is a visual modeling

language based on standard notation to describe systems in terms of objects, relationships, interactions, sequence diagrams, and state changes.

Application of WEAP to Explore Future Water-Related Scenarios, Mohammad Rayej (CA DWR)

WEAP (Water Evaluation and Planning model) is a comprehensive, flexible and user-friendly analytical tool for integrated water resources planning. It integrates sources of supply in the system, (e.g., streamflow, groundwater, reservoirs, waste-water treatment plants, desalination plants and water transfers) with the demand side of the equation; urban, Ag, and environment. Its branching and hierarchal capability allows the demand side to be disaggregated down to the lowest level of use; single-family (showers, toilets, washing), crop consumptive use, and instream flow requirements. At the heart of WEAP is the concept of scenario analysis. WEAP computes current level of water supply and demand and projects them into the future based on the given sets of forecasting assumptions and functions under each scenario. Under each scenario WEAP evaluates future water supply and demand conditions under a wide range of scenario factors, e.g., changes in population growth, reservoir operating rules, irrigation technology, or climate change affects on hydrology. Management strategies, like supply augmentation or demand reduction measures, are then evaluated in response to water situation under each scenario. WEAP not only simulates current and future water condition, but also gives a complete picture of water condition for years in-between as it steps through time.

New Investments in Water Portfolios, Todd Hillaire (CA DWR)

This presentation describes how the California Department of Water Resources is making new investments in support of improved and more detailed Water Portfolio data. As first presented in California Water Plan Update 2005, Water Portfolios describe actual year conditions in terms of both quantity and quality of water supplies, uses, and the final disposition of those uses throughout California. Ambitious new improvements to Water Portfolios include implementing an inflow-outflow method to better represent water supplies and the disposition of their uses and applying this method for each Detailed Analysis Unit (DAU) by County and each sector of use within that DAU/County area. This methodology will improve the representation of water supply and delivery systems as well as capturing the reuse (e.g., recycled water, return flows) within and between each sector of use. Investments also include developing water use applications that aggregate water use and water balance parameters from sub-DAU/County units, such as water agencies, industries, etc. As an example, application development for the California Urban Water Use Model will have the functionality to represent, analyze, and aggregate urban water uses developed from public water supply systems, self-supplied water uses, and estimation of unmeasured water users. Similar methodologies are currently being evaluated for agricultural and managed wetlands representation.

Session Twelve: Modeling Conjunctive Use in the Central Valley

Moderator: Julien Harou (UC Davis); Location: Oak Shelter

Climate Change and Conjunctive Use in California, Sebastian Vicuna (UC Berkeley), John Dracup (UC Berkeley), and Larry Dale (LBNL) (.PDF; 1 MB)

There is a growing evidence of the climate change impacts that could potentially affect water resources in snow-dominated regions throughout the world. In California, one of these regions, climate change scenarios project with high confidence an increase in temperature levels. This temperature increase would affect streamflow timing which plays an important role in determining the performance of California water resources systems where there is a clear mismatch between the time the water is available and the water is needed. However there is still a lot of uncertainty in terms of the changes that would occur in annual precipitation which has been shown to be the most significant determinant of climate change impacts on water resources. The uncertainties associated with these projections of precipitation levels have made it difficult to design adaptation strategies that could cope with the hydrologic changes associated with climate change. In this project we are developing an optimization technique based on Sampling Stochastic Dynamic Programming that takes into account explicitly the uncertainty associated with climate change projections into the future. Using this technique we are looking (if existent) in a groundwater and surface water conjunctive use setting for robust adaptation policies that could accommodate both impacts on the precipitation and temperature levels. Contributors: J. A. Dracup (UC Berkeley) , L. L. Dale (Lawrence Berkeley National Laboratory)

Groundwater Availability in California's Central Valley: An Updated Central Valley Regional Aquifer System Analysis Model, Claudia Faunt, Randall Hanson and Kenneth Belitz (USGS San Diego)

California's Central Valley is one of the most productive agricultural regions in the world; however, large increases in population have increased the competition for surface and ground water within the Central Valley and statewide. To better assess and quantify the ground-water resources in the Central Valley, a previously developed ground-water flow model of the valley has been updated. The 10-layer ground-water flow model comprises 20,533 one-mile-square cells that are populated with a textural analysis made using 8,497 driller's logs. Agricultural pumpage is an important model stress that is often poorly recorded; therefore, a coupled farm-process model is used to estimate historical pumpage and simulate the delivery of surface water since the 1960s for 21 water-balance regions. Overall, surface-water deliveries supply most of the agricultural demand in the initial part of the growing season, augmented by increased ground-water pumpage later in the season. In addition, the relative proportions of surface water and ground water used for irrigation vary from year to year in response to climate. Finally, the updated model is being used to evaluate the effects of human activities on water levels, ground-water storage, ground-water discharge to streams and other surface-water bodies, and the adequacy of data networks. Contributors: Randall T. Hanson (USGS San Diego), and Kenneth Belitz (USGS San Diego)

Numerical Illustrations of the Discrete Kernels Approach to Modeling for Conjunctive Use, Hubert Morel-Seytoux (Hydroprose Consulting)

The theory behind the "Discrete Kernels (DK)" approach is briefly discussed. This approach has received different names, such as "Response functions", "Green's functions", "Unit Hydrograph", and others. The emphasis will be on the concepts of the (1) "Scanning Grid (SG)", (2) "Artificial Steady-State Past (ASS)", (3) "Sequential Reinitialization", and (4) the "Two-Steps" procedure, which are the distinctive contributions of the DK approach. These concepts are illustrated on an hypothetical aquifer, showing that the SG technique, properly used, does not result in a loss of accuracy. When a stream is present two procedures are possible. The first incorporates the influence of the stream in the system of groundwater equations and the discrete kernels are generated that incorporate the impact of the stream. The second procedure (the two-steps procedure) generates the

discrete kernels, first without the influence of the stream, and then corrects them to account for the interaction. That procedure has the advantage that if the exchange coefficient for flow between the aquifer and the stream has changed (e.g. if the stream loses connection with the aquifer) only the correction equations need to be solved again since the discrete kernels for the groundwater without the stream have not changed.

A Hydro-Economic Conjunctive Use Optimization Model of the Sacramento Valley,
Julien Harou and Jay Lund (UC Davis) (.PDF; 0.6 MB)

Water resource system planning models that include surface and groundwater have often represented aquifers with simplified lumped sub-basins. Recently, systems models increasingly use embedding or response function approaches to incorporate spatially distributed groundwater representations. Deterministic multi-period optimization models can be useful to analyze the operation of regional systems. They provide time series of optimal flows and storages which can be analyzed to identify promising water management patterns and insights. This presentation will describe initial design and construction of a hydro-economic monthly planning optimization model of California's Sacramento Valley. The proposed model includes a network-like representation of surface water and an embedded finite-difference groundwater model (2-D simplification of CV-RASA1). Embedding is performed using an efficient eigenvalue solution of the spatially discretized but time-continuous groundwater flow equation. This allows relatively detailed modeling in areas of interest (such as near water bodies) and coarser modeling where only regional groundwater elevations are required. System operation is driven by minimizing costs associated with operation and water scarcity. Water scarcity costs are estimated from urban and agricultural water demand curves. Dynamic pumping costs require the model to be non-linear. To limit model size and hydrologic foresight, sequential annual runs combined with carry-over storage value functions are considered. Contributor: Jay R. Lund (UC Davis)

4:15-6:00 p.m.

Session Thirteen: Screening/Decision Support Modeling for California Water Management

Moderator: Armin Munévar (CH2M Hill); Location: Fred Farr Forum

Impacts of Uncertainty in Efficient Management of California Water Resources
Newsha Ajami (UC Berkeley) (.PDF; 3 MB)

Taking steps toward sustainable management of California's water resources is a crucial issue since the state is facing major challenges. The ever increasing water demand from different sectors, especially municipal and agricultural demands caused by the state's growing population, increases the vulnerability of the system to water supply shortfalls and water quality issues. California's diverse range of climate zones, limited water supply and economic dependence on water-reliant industries such as agriculture calls for an integrated, efficient and sustainable management of water resources. Berkeley Water Center has taken the initiative to build an open and flexible platform that connects all California's water systems which would enable the decision makers to more efficiently manage state's water resources by testing different possible coordinated operational scenarios. To do so we are currently conducting a pilot project which focuses on some of the raised issues in a smaller scale. As part of this effort we intend to identify and assess end-to-end uncertainty in the water resources management system and here I will demonstrate the impacts of these sources of uncertainty for efficient decision making by water resources managers.

Dynamic Modeling for Oakdale Irrigation District Water Management
Jeanne Brantigan (CH2M Hill) (.PDF; 4.6 MB)

Oakdale Irrigation District (OID), a 100-year-old irrigation and domestic water service provider in California's San Joaquin Valley, recently developed a long-term Water Resources Plan (WRP) to evaluate a multitude of possible water management decisions to respond to land use changes, out-of-date infrastructure, and increased outside scrutiny of its water use.

The project team integrated various cutting-edge tools and analyses to holistically evaluate multiple options that would respond to changing customer needs within the District and increased scrutiny of its water use. VOYAGE™ was one tool used to facilitate quick evaluations of multiple variables related to land use. The model was customized to OID using used land use, infrastructure, and on-farm survey information. Several time-dependent variables were then simulated, including rainfall data, availability of water supplies, reservoir operations, system demands, water reuse, and conservation, to facilitate operational decisions under a variety of hydrologic conditions. Model results were then used in conjunction with a detailed financial model to assist in prioritizing infrastructure improvements and comparing the relative benefits of alternative water management actions including transfers, annexations, and on-demand deliveries.

Key benefits of the WRP include protecting the District's water rights, increasing reliability during droughts, and meeting the needs of its current and future customer base by modernizing and expanding service.

Metropolitan's SWP Supply Forecasting and Optimal Scheduling
Peter Louie and Tony Liudzius (MWDSC)

The Metropolitan Water District of Southern California (Metropolitan) participates in a number of water storage/exchange programs with agencies located outside of its service areas as well as with its own member agencies located within. In addition to improving water supply reliability during dry periods, it is also desirable to improve Metropolitan's water quality. The proposed study investigates how these objectives can be achieved by utilizing the storage/exchange programs and re-operating reservoirs and altering the delivery patterns of the SWP supply. Many of these programs rely on the California Aqueduct to convey water to and from the participating agencies; therefore, changes in the SWP operations would have a direct impact on the water storage/exchange programs.

The proposed modeling process starts with a forecasting module that generates possible sequences of hydrology (water supply conditions) and water quality occurrences at the Delta export. Operational decisions for the water storage programs would be triggered by certain threshold conditions (forecasted water quality and water supply allocations). At that point, the optimization procedure would be activated to search for the optimal scheduling options (programs and resources mix) and operational adjustments to the system (delivery and storage patterns) subject to the constraints of both physical system capacity and institutional and contractual requirements of the local systems (ground and surface water).

Session Fourteen: Integrated Regional Modeling
Moderator: Ali Taghavi (WRIME)
Location: Oak Shelter

Integrated Modeling Concepts and how they support Integrated Basin Planning,
Ali Taghavi (WRIME)

Abstract Not Available.

Integrated Modeling: An Analytical Tool for Integrated Regional Water Management Plan Development – Application to Kings Basin, Reza Namvar (WRIME) (.PDF; 6.7 MB)

An Integrated Groundwater and Surface water Model (IGSM) was developed as an analytical tool for development of Kings Basin Integrated Regional Water Management Plan (IRWMP). Kings Basin covers an area of about 1,600 square miles. Water use in this basin consists of approximately 2,700 TAF agricultural and 170 TAF urban water use which is met by 1,800 TAF of groundwater and 1,070 TAF of surface water. Kings River, with an average annual stream flow of 1,600 TAF, is the primary source of surface water for the basin. This analytical tool is being used to evaluate IRWMP alternatives and water management strategies. The alternatives include regional groundwater direct and in-lieu recharge projects and regional groundwater banking.

HydroGeoSphere: Ongoing Model Enhancements and Applications in Central Valley and Upper Klamath River Basin, George Matanga (USBR) (.PDF; 2.4 MB)

Optimal management of water resources at a watershed scale requires consideration of comprehensive restoration and long-term protection of complex subsurface and surface-based ecosystems. The surface-based ecosystems are closely interconnected and include aquatic habitats (stream channels, wetlands, vernal pools, lakes, periodic floods and other surface-water bodies); riparian zones; lowlands (valley floor); and uplands (mountains). From a hydrology perspective, the surface-based ecosystems are known to closely interact with the subsurface ecosystem. In this work, the surface-based ecosystems are treated as two-dimensional systems, while the subsurface ecosystem is handled as a three-dimensional system. The riparian zones are generally small in area in comparison to the landscapes of lowlands and uplands. Therefore, in order to accurately evaluate the hydrological and ecological processes at a watershed scale, in terms of process simulation, it may be necessary to apply a small scale (refined model grid) for the stream channels and riparian zones and a large scale (coarse model grid) for the lowlands and uplands. Therefore, appropriate numerical models for hydrological/ecological analyses require capability to account for the multi-scales in management of water resources and ecosystems in a watershed. Success of predictive and conjunctive analyses of hydrological and ecological or biogeochemical processes in integrated subsurface and surface (or surface-based ecosystem) regimes depend on availability of robust numerical models, with capability to account for hydrological and ecological processes within and at the interfaces of the subsurface and surface water regimes and interconnected ecosystems. Capability to accurately account for integrated and interconnected processes will facilitate accurate evaluation of fluid, energy and chemical exchange between subsurface and surface water regimes, and adjacent ecosystems. Understanding of hydrological and ecological processes is valuable in management of water resources and ecosystems. Issues of concern in management of water resources need to include optimal allocation of scarce water resources, water quality, and ecosystem health. For the first presentation, “HydroGeoSphere: Brief Overview and Enhancements for Integrated Water Supply, Water Quality and Ecosystem Health Analysis”, the following enhancements for improving model capabilities for ecosystem analysis will be discussed: snowmelt; extension of temperature (heat) transport to all domains; dissolved oxygen (DO) and nutrient (N, P) transport and reactions; sediment transport and linkage to CalSim. For the second presentation, “HydroGeoSphere: Model Applications in Central valley and Upper Klamath River Basin”, the following applications will be presented: feasibility study of an off-stream reservoir in Long Lake Valley of Upper Klamath River Basin; evaluation of interaction between surface and subsurface water regimes in Sacramento River Basin; Testing of sub-timing and sub-gridding schemes incorporated into the model; and modeling support for San Joaquin River Restoration Program.

HydroGeoSphere: Model Applications in Central Valley and Upper Klamath River Basin, George Matanga (USBR) (.PDF; 6.3 MB)

See abstract above.

7:00-9:00 p.m.

Session Fifteen: Evening Program

Moderator: Nigel Quinn (LBNL / USBR); Location: Fred Farr Forum

7:00-10:00 p.m. Reception II

7:45-8:30 p.m. Presentation of the Hugo B. Fischer Award and Remarks by the Hugo B. Fischer Award Recipient

The CWEMF Hugo B. Fischer Award, which is made in honor of Dr. Hugo B. Fischer's pioneering work on water quality modeling for the Bay-Delta system, recognizes pioneering contribution(s) to the use of modeling for understanding or solving California water problems. More specifically, the award, which was conceived and endowed by Lyle Hoag, retired Executive Director of California Urban Water Agencies and a co-founder of the CWEMF, is given annually for (1) innovative development, refinement, or application of a computer model or (2) significant furtherance of the effective use of models in open forums for planning or regulatory functions that benefit California water stakeholders and decision makers.

The recipient will discuss the modeling-related work associated with the award.

8:30 p.m.-9:15 p.m. Presentation of the Career Achievement Award and Remarks by the Career Achievement Award Recipient

The CWEMF Career Achievement Award is given annually to individuals for significant contributions over their career in developing, using or promoting computer modeling to analyze California's water-related problems. More specifically, the CWEMF Career Achievement Award recognizes sustained and significant contributions that (1) increase the usefulness of models in water management analyses in California, (2) promote sound quantitative analyses in water management decisions and (3) raise public awareness and improving public acceptance of the role of modeling.

The recipient will discuss the modeling-related work associated with the award.

2007
Annual Meeting
Abstracts

Wednesday, February 28, 2007

8:15-10:00 a.m.

Session Sixteen: Early Awakenings for Delta Visions
Moderator: Jay Lund (UC Davis); Location: Fred Farr Forum

Modeling Statewide Water Supplies Without Delta Exports, Stacy Tanaka (UC Davis)

Abstract Not Available.

Modeling Effects of Salinity Scenarios on Agricultural Economics in the Delta, Marcelo Olivares (UC Davis)

Abstract Not Available.

Modeling to Suggest Promising Solutions to Stakeholders, Jay Lund (UC Davis)

Abstract Not Available.

Delta Hydrodynamics and Tidal Prisms, Richard Rachiele (RMA)

Abstract Not Available.

Session Seventeen: General Reservoir Simulation Model Applications
Moderator: Leslie Stillwater (USBR); Location: Oak Shelter

HEC-ResSim Modifications: Better Tools to Simulate the Operation of California Reservoirs, Joan Klipsch and Tom Evans (USCOE)

In collaboration with a group of California water agencies, the U.S. Army Corps of Engineers' Hydrologic Engineering Center (HEC) is developing enhancements to its reservoir simulation modeling program, HEC-ResSim. Significant modifications to HEC-ResSim's computation methods in this project include improvements to emergency spillway release diagram (ESRD, or induced surcharge) computations to improve the program's ability to represent operations in severe flood conditions and improvements to the downstream-control algorithm to account for operational rate-of-change constraints. Additionally, new program features will enable HEC-ResSim to be integrated into the National Weather Service's River Forecasting System (NWS-RFS). The Yuba-Feather study team selected HEC-ResSim as the modeling tool best able to represent the operational goals and constraints on the two major flood control reservoirs, Oroville and New Bullards Bar, in the Yuba-Feather watershed. However, after careful review of existing HEC-ResSim models of the basin, the team identified these enhancements as necessary to fully represent the operations of the two reservoirs in a real-time decision support tool--the ultimate objective of the study.

RiverWare: Generalized River Basin Modeling, Tim Magee (CADSWES, U. of Colorado) (.PDF; 6 MB)

RiverWare is a generalized river basin modeling tool used by U.S. Bureau of Reclamation, the Tennessee Valley Authority, the U.S. Army Corps of Engineers, and numerous other water management agencies, utilities and consultants. Modelers develop and run site-specific RiverWare models without the need to develop and maintain software. Models are built by selecting from a variety of predefined water objects and linking them together. Objects are configured by selecting methods such as alternative routing algorithms. The time steps of models range from hourly to yearly, and the resulting models are used for everything from daily operations to long term planning. RiverWare has three solution mechanisms: pure simulation, rule based simulation, and optimization (preemptive linear goal programming). For the latter two (multi-objective) solution approaches, users use a syntax-directed editor to create prioritized operational policies that drive the solution. Policies have ranged from the "Law of the River" for the Colorado River to economic use of hydropower at TVA. Policies in the model can easily be modified to reflect actual changes or proposed changes such as those in an environmental impact statement. RiverWare also includes tools for risk-based decision making and for allocating water rights and tracking water accounting.

Groundwater/Surface Water Conjunctive Management for Pacific Northwest Projects
Leslie Stillwater (USBR) (.PDF; 2.5 MB)

Abstract not available.

10:15 a.m.-12:00 p.m.

Session Eighteen: Temperature Modeling and Applications

Moderator: Mike Deas (WaterCourse Engineering); Location: Fred Farr Forum

Cold Water Inflow into a Reservoir: Field Data and Modeling Study
Rachel Simons (EBMUD) (.PDF; 4 MB)

The East Bay Municipal Utility District operates two reservoirs in series, Pardee and Camanche, on the Mokelumne River in Northern California. Camanche, the lower reservoir, releases water into the Lower Mokelumne River, which contains habitat for Chinook salmon and steelhead trout. The health of both these species is closely linked to water temperature. Pardee, the upper reservoir, is deeper and has less surface area than Camanche and consequently maintains a colder hypolimnion throughout the year. To minimize the temperature of the Camanche hypolimnion during the hot summer months, cold water is released into Camanche from Pardee. The cold water releases made from Pardee must travel down a two-mile stretch of unshaded river and plunge below the warm stratified surface waters of Camanche before reaching the Camanche hypolimnion. In this study, field data and modeling are used to explore the relationship between flow rate, stratification, and warming as they influence the cold water releases made from Pardee into Camanche.

Upper Yuba River Temperature Model, Niels Riegels (CH2M Hill) (.PDF; 4 MB)

A water temperature model of the Upper Middle and South Yuba Rivers was developed to help evaluate the feasibility of introducing Chinook salmon and steelhead above Englebright Dam. The model is intended to be a preliminary screening tool for evaluating the effect of incremental flow increases on water temperature during summer base flow conditions. The model approach and development process will be described, with an emphasis on methods used to represent the highly variable channel morphology of mountain streams.

Trinity River Flow and Temperature Modeling, I.E. (Ert) Sogutlugil (Watercourse Engineering)

A hydrodynamic and water temperature model was developed to assess sub-daily flow and thermal conditions in the Trinity River and lower Klamath River. The Trinity River is represented from Lewiston Dam (River Mile (RM) 110) to the confluence with the Klamath River (RM_{KR} 40) and the lower 60 miles of the Klamath River. Challenges include topographic shade representation in this mountainous region, and estimating tributary temperatures during spring snowmelt periods. Model applications will support operations planning and management to protect anadromous fish populations in the region.

The Virgin River Operations Optimization Model, Leon Basdekas (WaterCourse Engineering)

The Virgin River Operations Optimization Model is an integrated modeling framework consisting of an integrated operations model, temperature model, and a temperature based habitat suitability metric. The new fish habitat metric was developed based on thermal limiting factor analysis. For a demonstration project the modeling tool was applied to the Virgin River Basin and the endangered woundfin minnow. The two optimization objectives were to minimize net cost and maximize endangered fish habitat for various hydrologic year types and water demand conditions. Dry, average and wet hydrologic year types were modeled separately in combination with existing water demands and a future water demand estimate. Infrastructure options considered were 1) a gravity fed pipeline to transport water from Quail Creek Reservoir upstream to discharge cold water in the Virgin River, 2) the proposed Lake Powell pipeline to Sand Hollow reservoir to satisfy anticipated population growth and 3) reduction in demand by purchasing water rights and removing those from the diversion demand.

Session Nineteen: Climate Change Modeling

Moderator: John Andrew (CA DWR); Location: Oak Shelter

Global Warming Effects: Initial Results for 2025, Tuolumne Basin
Bruce J. McGurk (Hetch Hetchy Water and Power, SFPUC) (.PDF; 1.3 MB)

Eighty-five percent of the water supply for 2.4 million people in the Bay Area comes from Hetch Hetchy Reservoir on the Tuolumne River. The Hetch Hetchy watershed ranges from 3,800 to 12,000 feet, and 87 percent of the watershed area is above 6,000 feet. A rise in temperature of 1.5 ^{o}C between 2000 and 2025 will result the snowline moving from 6,000 to 6,500 feet and faster melting of the snowpack above 6,500 feet. Similarly, the snowline will have risen to 7,000 feet in 2050 and to 8,000 feet in 2100. The snow-free portion of the basin will rise from 13% in 2000 to 57% by 2100. This change will produce a shift in runoff timing: more runoff during the early winter and less snowmelt at the end of the winter. By raising daily maximum and minimum temperatures in our monthly forecasting model to simulate climate change, about 7 percent of the runoff currently draining into Hetch Hetchy Reservoir will shift from the spring and summer seasons to the fall and winter seasons by 2025. This percentage is within the current interannual variation in runoff and is within the range accounted for during normal runoff forecasting and existing reservoir management practices. As the warming process continues and if even larger shifts occur, reservoir operational strategy will have to be changed.

Exploring the Use of Risk Analysis to Study the Effects of Climate Change on Central Valley Project and State Water Project Operations, Levi Brekke (USBR)

This presentation highlights research on the use of risk analysis to study climate change effects on California's Central Valley water and power operations, which are sensitive to regional air temperatures, precipitation timing and type, runoff timing and quantities, and sea level conditions. Much has been discussed about how to assess potential impacts from regional climate change,

and how such assessments might inform long-term water resources planning. Recent approaches have involved analyzing broad ensembles of climate projection scenarios to reveal impacts uncertainty. This work features similar ensemble impacts analysis, but also features methods to estimate relative scenario probabilities. Integrating impacts and probability components across scenarios allows the discussion to move beyond assessment of potential impacts to assessment of risk.

The research considers two ensembles of 21st Century IPCC AR4 projections at two climatological horizons: "2011-2040" and "2041-2070". The ensembles are labeled: impacts and uncertainty. The impacts ensemble consists of 22 projection scenarios that have been statistically downscaled over the Central Valley watershed and subjected to scenario-specific impacts analyses on headwater runoff, reservoir operations, and managed stream temperatures. The uncertainty ensemble consists of 75 projection scenarios, including the nested impacts ensemble, and provides the basis for estimating relative scenario probabilities. Nonparametric techniques are used to separately construct functions describing the range and consensus among projected temperature, precipitation and joint temperature-precipitation conditions in the uncertainty ensemble. Scenario-weighting derived from climate model-weighting is considered in this construction, building from the assumption that a climate model's credibility in 21st century projection is related to its capability in recreating of 20th century climate statistics.

Methods will be presented on estimating climate projection uncertainty, their application to produce projection distribution functions specific to projection parameter(s) (i.e. temperature, precipitation, and joint precipitation-temperature), and how relative probabilities were extracted from these functions for impacts ensemble scenarios. Given how scenario probabilities differ depending on the reference function, the presentation will show how the characterized risk for several impacts metrics is affected by choice of reference function.

Co-investigators: J. Anderson (Department of Water Resources), E. Maurer (Santa Clara University), M. Dettinger (US Geological Survey/Scripps Institute of Oceanography)

Challenge of Updating Reservoir Regulation Curves Considering Climate Change/Variability, Stu Townsley (USCOE) (.PDF; 1 MB)

The vastly improved science of climate change predicts greater climate variability and accelerated global warming in the coming decades. The signs are visible in California even now: peak Sierra snowmelt occurs three weeks earlier in the season; corresponding data show increased storm variability.

At the same time, reservoir regulation curves for the Central Valley—the curves that guide decisions that prevent flood damage and ensure adequate water supply—are 50 years old. As a result of climate changes, these rule curves may no longer call for sufficient mid-winter flood pools; the allowable re-fill determined by them may now be weeks late.

Although it is still unclear how to include the coarse global and regional time steps of the new climate models into new rule curves, it is clear that to operate effectively, California's water managers will need results from spatially and temporally downsized models and up-to-date rule curves that consider current climate data as the basis for developing new reservoir regulations.

57-year Downscaling of California Climate Reanalysis to 10km Horizontal Resolution Hideki Kanamaru (Scripps Institute of Oceanography, UC San Diego) (.PDF; 1.4 MB)

Climate research, particularly application studies for water, agriculture, forestry, fishery and energy management require fine scale multi-decadal information of meteorological, oceanographic and land states. We produced California Reanalysis Downscaling at 10km

(CaRD10) – a spatially and temporally homogeneous climate dataset for such applications. The NCEP/NCAR global reanalysis for the period 1948-2005 was dynamically downscaled to hourly, 10 km resolution over California using the Regional Spectral Model. An extensive validation of the downscaled analysis was performed using station observations and gridded data. In general, the CaRD10 near-surface wind and temperature fit better with regional scale station observations than the NCEP/NCAR reanalysis used to force the regional model, supporting the premise that the regional downscaling is a viable method to attain regional detail from large scale analysis. This advantage of CaRD10 was found on all time scales, ranging from hourly to decadal scales, i.e. from diurnal variation to multi-decadal trend. Dynamically downscaled analysis provides ways to study various regional climate phenomena of different time scales because all produced variables are dynamically, physically and hydrologically consistent.

1:00-2:40 p.m.

Session Twenty: Water Community Program Updates

Moderator: Fred Feyrer (CA DWR); Location: Chapel

Welcome and IEP Update, Chuck Armor (CA DFG)

The IEP will summarize its 2006 activities.

CWEMF Update, KT Shum (CWEMF Convener/EBMUD)

The CWEMF will summarize its 2006 activities.

CALFED Science Program Update, Michael Healey (CBDA)

The CALFED Science Program will summarize its 2006 activities.

Future of the Delta I, Jeff Mount (UC Davis)

This 2007 PPIC report explores and compares long-term Delta solutions. The authors consider nine alternatives for Delta management and evaluate the performance of each in three key areas: water supply, environmental effects and economic costs. Some key findings and recommendations:

- Although changes will result in some significant costs and dislocations, most users of Delta services can adapt economically.
- Strong political and institutional leadership is needed to address the Delta crisis. Since mid-2006, the body responsible for coordinating CALFED, the Delta's joint federal and state program, has been operating without independent authority or budget.
- Scientific work in the Delta needs to be refocused. Levee replacement, experiments in adapting the ecosystem, flood control and island land management should be key components of a new problem-solving framework.
- Direct beneficiaries of the Delta should be primarily responsible for financing solutions and should make up-front commitments. Public funds should be reserved for the truly public components of any investment. Moreover, in the wake of a natural catastrophe, an effective funding mechanism will be essential to avert financial disaster for state and local interests.

Future of the Delta II, Jay Lund (UC Davis)

See Abstract Above.

3:00-4:40 p.m.

Session Twenty-One: IEP / CWEMF Joint Modeling Session

Moderator: Paul Cadrett (USFWS); Location: Chapel

San Joaquin River Restoration Settlement Agreement, Russ Bellmer (NOAA Fisheries)

Abstract not available.

Habitat Management, Preservation, and Restoration Plan for Suisun Marsh, Laurie Briden (CA DFG) and Cassandra Enos (CA DWR)

Abstract not available.

Overview of the 2005 LIDAR Elevation Data Acquisition for the Suisun Marsh and Yolo Bypass, Joel Dudas (CA DWR)

Abstract not available.

LIDAR Applications, Chris Enright (CA DWR)

Abstract not available.

IEP Delta Smelt Programmatic Review, Gonzalo Castillo (USFWS)

Abstract not available.

7:00-9:00 p.m.

Session Twenty-Two: IEP Social and Guest Speaker

Moderator: IEP Representative
Location: Chapel

Guest Speaker: John O'Sullivan, Monterey Bay Aquarium Curator of Field Operations

Monterey Bay Aquarium's White Shark Research Program

Abstract not available.